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[54] **TOOTHBRUSH WITH SELF-CONTAINED TOOTHPASTE DISPENSER**

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[52] **U.S. Cl.** ..... **401/176**; 401/188 R; 401/190; 401/271; 401/280

[58] **Field of Search** ..... 401/176, 180, 190, 271, 401/278–280, 157, 187, 188 R, 206; 251/321, 326

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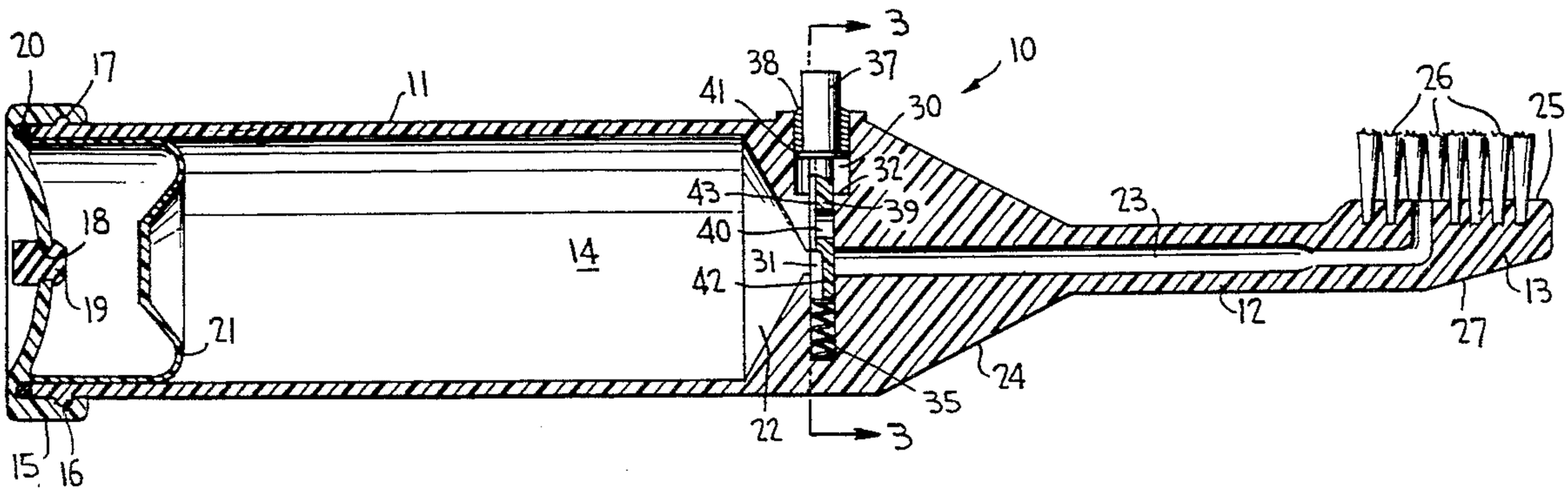
Primary Examiner—Danton D. DeMille

[57] **ABSTRACT**

A fountain toothbrush has in its handle a toothpaste reservoir constantly pressurized by a charge of actuator gas acting through a cup-like piston disposed at the upstream end of the reservoir. The gas pressure pushes the piston and toothpaste downstream while resiliently urging the piston sidewall against the reservoir boundary wall to forwardly extrude toothpaste adjacent the boundary wall. A valve for selectively passing toothpaste from the reservoir to the brush head includes an apertured gate and a structurally separate actuator for translating the gate in a valve chamber in opposition to a bias spring. Separating the gate from the actuator permits the gate to be positively sealed against the chamber outlet by the toothpaste in the closed valve position. A lengthwise segment of the gate has a reduced thickness dimension so as not to fill the upstream side of the valve chamber, thereby avoiding the creation of a partial vacuum that would otherwise hold the gate in its open position.

11 Claims, 2 Drawing Sheets



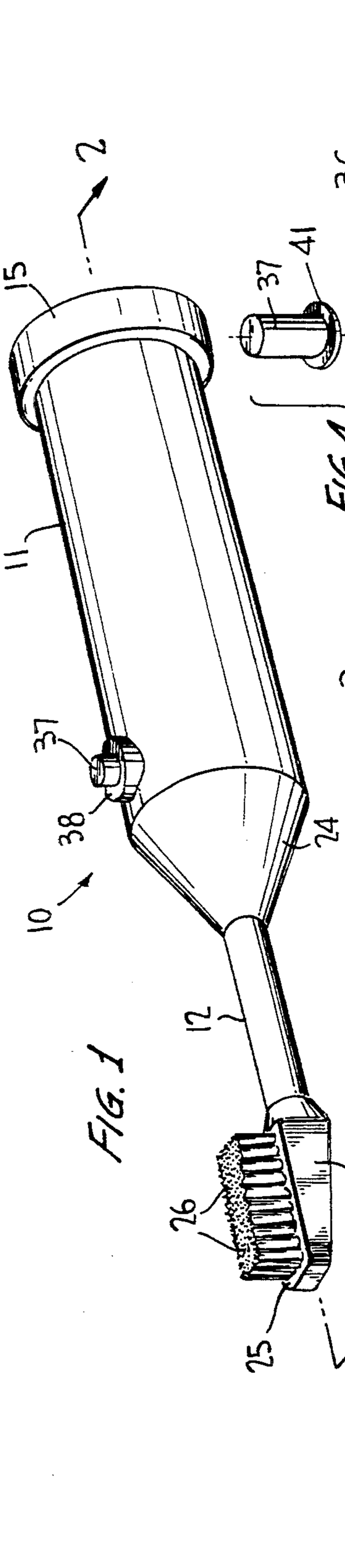


FIG. 1

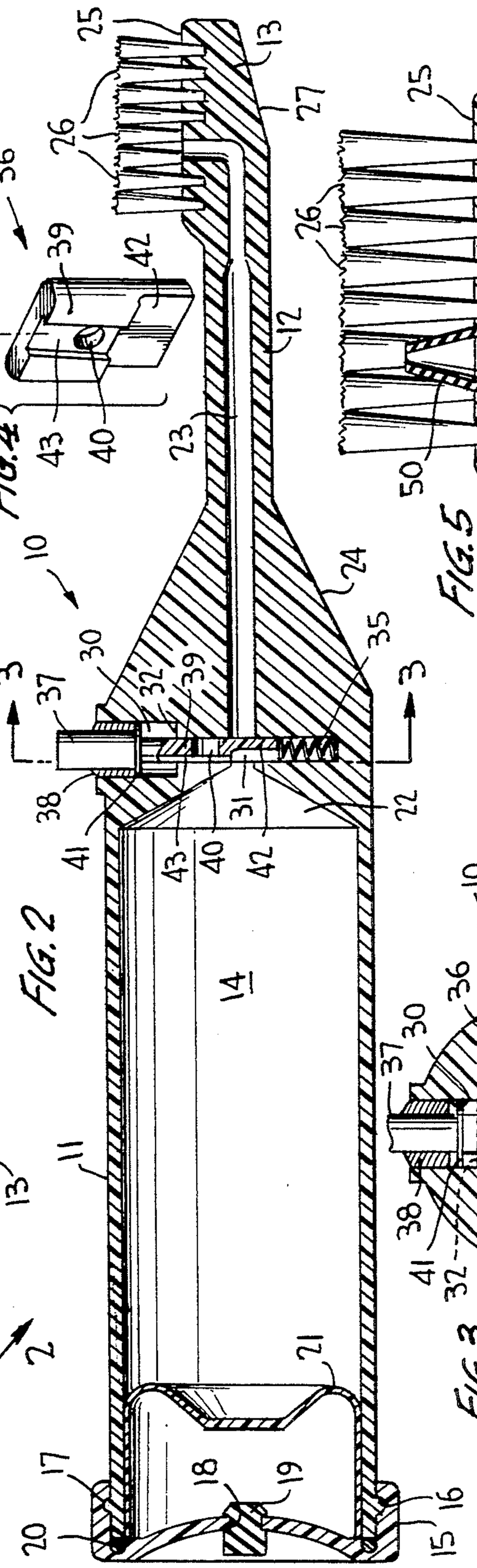


FIG. 2

FIG. 4

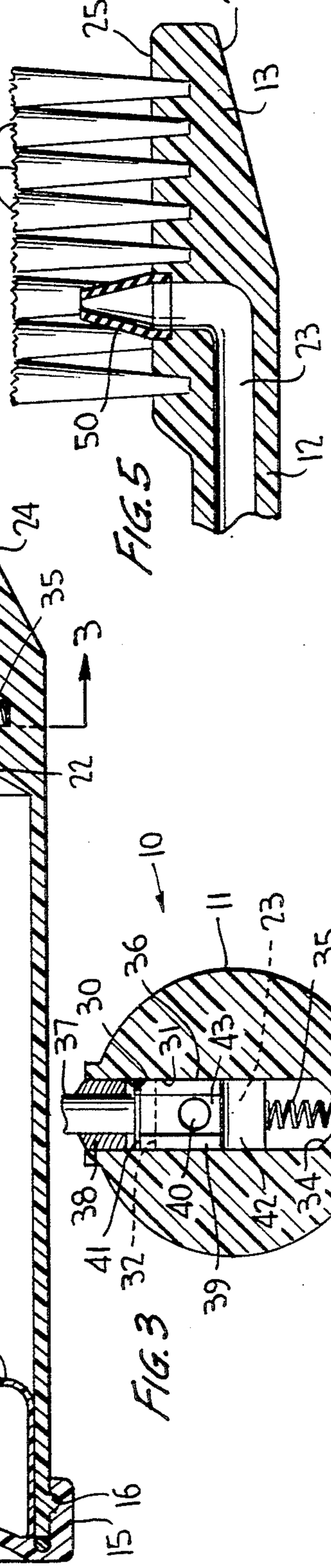


FIG. 5

FIG. 3

FIG. 6

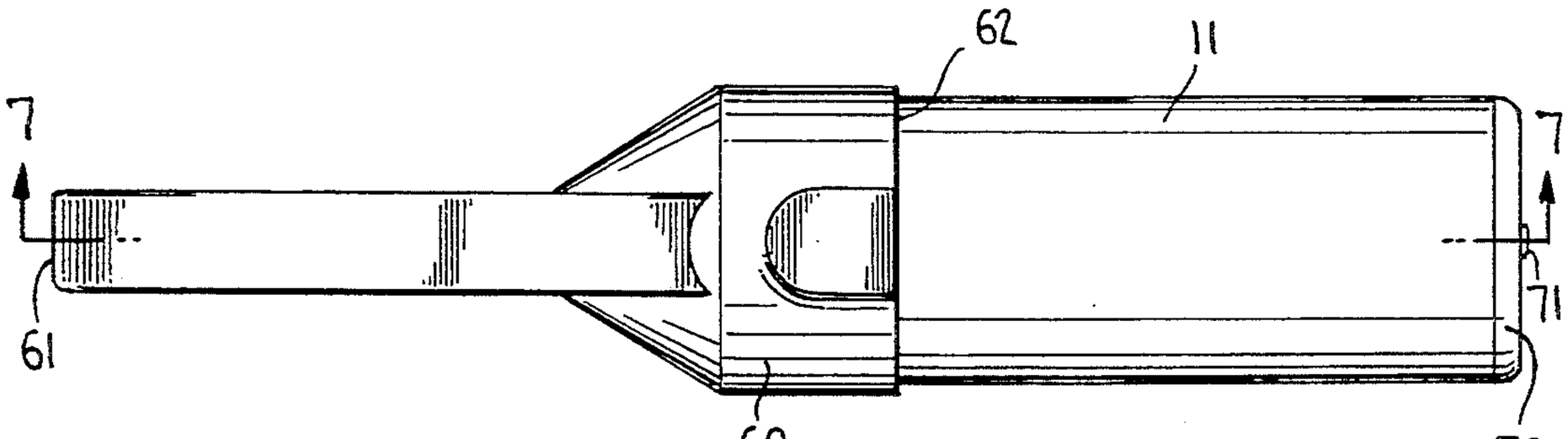
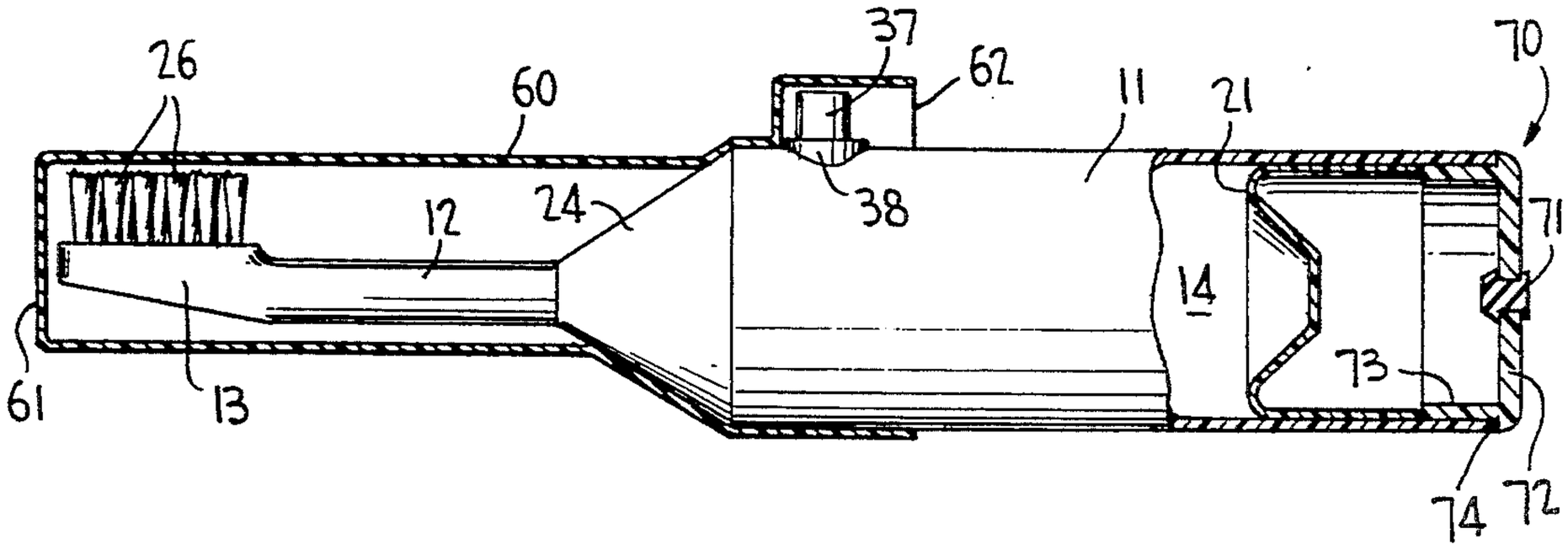


FIG. 7



TOOTHBRUSH WITH SELF-CONTAINED TOOTHPASTE DISPENSER

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to fountain toothbrushes having a built-in toothpaste reservoir and dispenser and, more particularly, to such fountain toothbrushes wherein the toothpaste is maintained under constant pressure so as to be selectively dispensed in response to actuation of a valve.

2. Discussion Of The Prior Art

It is well-known in the prior art to provide a toothbrush having a handle in the form of a reservoir for toothpaste that may be selectively dispensed. Such toothbrushes tend to fall into two categories, namely: those in which the toothpaste is normally not under pressure but is selectively pressurized to dispense the paste; and those in which the paste is under constant pressure and is dispensed by actuation of a valve. The former category is exemplified by the following patents: U.S. Pat. No. 2,226,663 (Hill et al); U.S. Pat. No. 995,626 (Moran); U.S. Pat. No. 4,693,622 (Booth); U.S. Pat. No. 3,995,648 (Kuryla); U.S. Pat. No. 4,269,207 (Konrad et al); U.S. Pat. No. 4,530,369 (Adams); U.S. Pat. No. 1,653,987 (Cliffe); U.S. Pat. No. 2,416,684 (Fischer); U.S. Pat. No. 2,441,520 (Ulvick); and U.S. Pat. No. 4,695,177 (Kuo). These pump-type devices all suffer from the disadvantage of inefficient evacuation of the paste reservoir, thereby resulting in significant amounts of wasted paste that cannot be pumped from the reservoir. In addition, the pump-type units usually require two hands to operate and thereby are no more convenient in use than a toothpaste tube and a separate brush.

Examples of toothbrushes with continuously pressurized paste reservoirs are found in U.S. Pat. Nos. 3,937,235 (Broughton) and U.S. Pat. No. 2,987,743 (Capps). In the Broughton patent the reservoir is pressurized by means of a plastic bag containing freon gas under pressure, the gas expanding the bag to pressurize the surrounding paste as the paste is dispensed. This arrangement is inefficient because the plastic bag tends to rollingly expand over some of the paste, trapping the paste against the reservoir wall and preventing it from being dispensed. The Capps patent discloses a reservoir wherein the paste is mixed with freon gas under pressure in the reservoir so that the gas and paste are dispensed together in response to actuation of a valve. The mixing of the gas and paste adds significantly to manufacturing time and cost. Moreover, the gas tends to discharge from the mixture before all of the paste is dispensed, thereby leaving a considerable amount of wasted paste in the reservoir. The Capps valving mechanism is somewhat easier to operate than the Broughton valve but requires that a spring be disposed directly in a toothpaste flow path with the result that the paste tends to collect on the spring and clog the dispensing path. In addition, actuation of the valve to dispense the toothpaste in the Capps arrangement requires movement of the toothpaste head relative to the reservoir/handle. This movement is not easily effected and, in any event, requires the use of both hands. The Capps valving mechanism itself requires a relatively complex set of parts, thereby adding to the overall manufacturing cost of the device. The cost of the product is also increased by the cost of the freon gas employed as the paste pressuring agent. Additionally, the possibility of the freon gas contaminating the toothpaste renders the Capps arrangement somewhat less than desirable.

OBJECT AND SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a method and apparatus for dispensing toothpaste to a brush from a reservoir in the brush handle whereby substantially all of the stored paste can be dispensed and wherein the dispensing actuator mechanism is both structurally and operationally simple.

It is another object of the present invention to provide a fountain toothbrush that is inexpensive to manufacture and can therefore be sold at a sufficiently low price to be disposable.

It is further object of the present invention to provide a unique valve structure for permitting selective dispensing of paste-like material from the reservoir.

Yet another object of the present invention is to provide an improved method and apparatus for continuously pressurizing toothpaste in a reservoir contained in a toothpaste handle.

In accordance with the present invention, and elongate reservoir disposed in a toothbrush handle has a cup-like piston initially disposed proximate the upstream end of the reservoir with the open side of the piston cup facing upstream or away from the paste. The piston periphery is contoured to match the interior boundary wall of the reservoir and provides a pressure seal between the downstream toothpaste and pressurized gas filling the upstream space. As toothpaste is dispensed from the downstream end of the reservoir, the pressurized gas causes the piston to move axially toward the downstream end. The pressurized gas maintains the sides of the piston cup in contact with the reservoir boundary wall causing the piston to push even the toothpaste disposed adjacent the reservoir wall in a downstream direction so that no wasted paste remains in the reservoir.

The actuator mechanism for the assembly includes a valve chamber in which a contoured gate member is slidable in a direction transverse to the flow path for the toothpaste. A spring, disposed out of the paste flow path, biases the gate to a position in the chamber wherein a flow aperture through the gate is out of alignment with the reservoir and outlet path. A push-button actuator on the handle is selectively actuable to translate the gate through the chamber in opposition to the spring bias, thereby positioning the gate aperture between the reservoir and outlet path and permitting toothpaste to flow to the toothbrush portion of the assembly. The gate and actuator are separate elements so that the gate can be forced flush against and positively seal the downstream opening of the valve chamber in the closed valve position. A slot or otherwise configured reduced thickness portion of the gate on its upstream surface prevents the gate from creating a partial vacuum in the valve chamber that would prevent the gate from freely moving.

The outflow passage to the bristle area of the brush maybe provided with a flexible orifice to limit exposure of the toothpaste to ambient air. Specifically, toothpaste, when exposed to air, tends to harden and clog outflow openings. The flexible orifice presents a small opening when not in use. Upon operation, the pressurized toothpaste expands that opening and drives the

relatively small amount of hardened paste out of the assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and still further object, features and advantages of the present invention will become apparent upon consideration of the following detailed description of specific embodiments thereof, especially when taken in conjunction with the accompanying drawings wherein like reference numerals in the various figures are utilized to designate like components, and wherein;

FIG. **1** is a view with perspective of a fountain toothbrush constructed in accordance with the present invention;

FIG. **2** is a view in longitudinal section taken along lines **2**—**2** of FIG. **1**;

FIG. **3** is a view in transverse section taken along lines **3**—**3** of FIG. **2** and showing the valving arrangement of the present invention;

FIG. **4** is a view in perspective of the gate and actuator members of the valving arrangement;

FIG. **5** is a detailed view in longitudinal section of the head portion of a modified form of the fountain toothbrush of the present invention;

FIG. **6** is a side view in plan of an alternative fountain toothbrush embodiment of the present invention; and

FIG. **7** is a view in longitudinal section taken along lines **7**—**7** of FIG. **6**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring specifically to FIGS. **1**–**4** of the accompanying drawings, a fountain toothbrush assembly **10** constructed pursuant to the present invention includes a handle **11** at one end, a head **13** at the opposite end and a stem **12** disposed between the handle and head. Handle **11** has a hollow interior chamber serving as a reservoir **14** for toothpaste, gel or other dentifrice. It is to be understood that, although the invention is described in connection with storing and dispensing toothpaste, suitable dentifrice gels, liquids and the like may also be employed without departing from the spirit of the invention. In the preferred embodiment reservoir **14** is cylindrical throughout the major part of its length, although any of a variety of different configurations maybe employed within the scope of the present invention. Likewise, the exterior configuration of handle **11** is primarily cylindrical. The interior wall of handle **11** defining reservoir **14** has a constant diameter and cross-section throughout the cylindrical length of the reservoir.

A cap **15** is secured to and seals reservoir **14** at the open proximal or upstream end of the cylindrical handle **11**. Cap **15** is a generally cup-shaped member with an exteriorly concave base and a short cylindrical sidewall having an interior diameter that closely fits over the outside wall of handle **11** at the proximal handle end. To retain cap **15** on handle **11** there is an annular recess **16** formed in the interior surface of the cap sidewall. Recess **16** is contoured to receive an annular projection **17** from handle **11** in snap-fit engagement. The arcuate base of cap **15** projects a short distance into the handle interior and is provided with a central aperture **18** into which an elastomeric plug **19** is stuffed in pressure-sealing engagement. Additional pressure sealing between cap **15** and handle **11** is provided by an annular gasket **20** disposed in an annular recess defined in the base of the cap **15** to bear against the annular proximal edge of handle **11** when cap **15** is properly secured to the handle in the manner illustrated in FIG. **2**.

A cup-like piston **21** is disposed within handle **11** symmetrically about the longitudinal axis of reservoir **14**. The open-end of piston **21** faces cap **15**, while the cylindrical cap sidewall bears against the cylindrical interior wall of the reservoir **14**. The forward end of piston **21** is closed so that the reservoir volumes on opposite sides of the piston are pressure-isolated from one another. The downstream or forward end of reservoir **14** is a frusto-conically tapered section **22** having a downstream termination at the upstream end of an outflow passage **23** that extends through stem **12**.

Stem **12** is a generally cylindrical section of smaller diameter than handle **11** and disposed coaxially with the handle. The transition between the larger diameter handle **11** and smaller diameter stem **12** is provided by a frusto-conical tapered section **24**. Outflow passage **23** extends from downstream reservoir section **22** coaxially through the interiors of tapered section **24** and stem **12** to the head **13** where passage **23** bends at a right angle to terminate at a bristle-retaining surface **25**. Multiple bristle-retaining recesses are defined in surface **25** and receive respective bristle tufts **26** secured in the recesses by a suitable adhesive. The bristle-retaining recesses are disposed in an ordered array that is interrupted only by the egress opening of outflow passage **23** at surface **25**.

The surface **27** of head **13** opposite bristle-retaining surface **25** is tapered or otherwise contoured as desired to facilitate efficient movement of the brush in the mouth of a user. In this regard, the arrangement of bristles **26** and the size of head **13** may be selected as desired to provide efficient brushing movements. Likewise, stem **12**, and passage **23** therein, maybe bent to orient head **13** at an angle relative to the handle axis as is provided in some toothbrush designs.

A valve arrangement is provided to permit selective control over the flow of toothpaste from reservoir **14** to the bristles **26** via outflow passage **23**. The valve arrangement includes a cylindrical bore extending radially inward from the external surface of handle **11** at a location adjacent the rearward end of tapered section **24**. A longitudinal axis of cylindrical bore **30** intersects the longitudinal axis of outflow passage **23**; however, the depth of bore **30** into the handle is insufficient for the bore to reach passage **23**. Rather, a bore **31** of generally elliptical cross-section extends coaxially from bore **30**, intersecting outflow passage **23** and extending radially through the handle beyond that passage. The major or long dimension of the cross-section of bore **31** is substantially equal to the diameter of cylindrical bore **30**, and the larger sides of the approximately elliptical cross-section are substantially flat. The major dimension of the cross-section of bore **31** is disposed transversely of the longitudinal axis of outflow passage **23**. The minor or smaller dimension of the cross-section of bore **31** is substantially smaller than the diameter of cylindrical bore **30** and is disposed parallel to the axis of outflow passage **23**. The transition between bores **30** and **31** takes the form of a shoulder **32** disposed in a plane parallel to the axis of passage **23**. At the bottom of bore **31** there is a short cylindrical bore **33** having a diameter substantially equal to the minor or smaller diameter of bore **31** and disposed coaxially with larger cylindrical bore **30**. Bore **33** is closed at its end opposite bore **31**. The major or longer dimension of bore **31** may include a tapered section **34** serving as a gradual transition between bores **31** and **33**; alternatively, this transition

maybe a generally elliptical shoulder. Bores **30**, **31**, and **33** constitute a valve chamber.

Within the valve chamber **30**, **31** and **33** there is a spring **35**, a gate **36**, an actuator **37** and an actuator retainer **38**. Spring **35** is a helical compression spring having one end positioned to abut the closed end of bore **33**, its other end extending into bore **31** in a radial direction with respect to handle **11**. The particular type of spring is not a critical feature of the invention so that, for example, the spring may be of the resilient wishbone type wherein the spring legs bias the gate toward the closed valve position. Gate **36** has one end abutting the end of spring **35** disposed within bore **31**. The other end of gate **36** projects into bore **30** wherein it abuts one end of actuator **37**. The actuator is retained in bore **30** by retainer **38** secured in place in the opening for bore **30** at the external surface of handle **11**.

Gate **36** is subdivided into two segments, namely: a relatively thick segment **39** abutting actuator **37**; and a thinner segment **42** abutting spring **35**. Thicker segment **39**, except for a longitudinally extending pressure relief slot **43** recessed into its upstream facing surface, has a peripheral contour matching, but slightly smaller than, the cross-section of generally elliptical bore **31**, thereby permitting the gate to freely slide within bore **31**. Slot **43** extends along the entire length of gate segment **39** at a relatively shallow depth into the thickness or minor dimension of the segment. A circular gate aperture **40** is defined through the minor dimension of gate segment **39** at slot **43** and has a diameter that is preferably slightly smaller than the diameter of outflow passage **23** at the point where passage **23** is intersected by bore **31**. The thinner gate segment **42** is thinner than segment **39** by virtue of having its entire upstream surface recessed to a greater extent than the recess at slot **43**. Segment **42** has the same major dimension as segment **39**. The transition between gate segments **39** and **42** may be a gradual taper; alternatively, the transition may be a sudden step.

The purpose of slot **43** is to provide a flow path for toothpaste between the valve chamber volumes above and below gate **36** on the high pressure side of the gate. In the absence of such a slot, gate **36** may sometimes move more slowly than desired when returning from its actuated position to its closed position under the influence of spring **35**. More particularly, toothpaste trapped in the chamber at the actuator end of the gate, and a partial vacuum created in the chamber at the spring end of the gate, combine to oppose gate movement. Slot **43** permits the pressurized toothpaste to flow into the chamber volume at the spring end of the gate to thereby equalize the pressure created across the gate by the toothpaste and permit the spring to quickly force the gate to its closed position.

Slot **43** also increases the upstream facing surface area upon which the pressurized toothpaste acts to enhance the sealing forces urging the gate into pressure-sealing contact with the downstream wall of the chamber.

Actuator **37** is a separate element having a cylindrical configuration with a widened base in the form of an annular flange **41** bearing against the end of segment **39** of gate **36**. Retainer **38** is an annular member engaged by force fit, adhesive, or the like, in bore **30**. A central aperture in retainer **38** receives actuator **37** in sliding engagement so that an end of the actuator projects out of bore **30** beyond the surface of handle **11**. Annular flange **41** is sufficiently wide to prevent actuator **37** from being readily pulled out of the retainer **38**.

In the fully extended state of spring **35**, gate **36** is positioned by the spring to align segment **42** with outflow passage **23**. Gate aperture **40** is thereby positioned out of alignment with passage **23**, and communication between reservoir **14** and passage **23** is blocked. In order to open the valve, actuator **37** is pushed through retainer **38** against the bias of spring **35** until gate aperture **40** is aligned with passage **23**.

In preparing the fountain toothbrush assembly **10** for use, cap **15** and piston **21** are removed from the assembly and toothpaste is loaded into reservoir **14** from the open upstream end of handle **11**. The volume of toothpaste placed in the reservoir should be such that, with the valve arrangement closed, the paste will be tightly packed and pressurized after piston **21** is in place at the upstream end of the reservoir. The piston is then forced into the upstream end and cap **15** is snapped into place to seal the interior volume. Pressurized air or other actuator gas is then injected, by means of a hypodermic needle or the like, through the elastomeric plug **19** in order to pressurize the interior space on the upstream side of piston **21**. Of course, other known techniques maybe employed to charge the upstream space with actuating gas. For a reservoir volume of 2.93 cubic inches, the initial actuating gas pressure in the upstream space would typically be thirty psig for an initial volume 0.5 cubic inches. These values, however, are not to be construed as limiting the scope of the present invention. The assembly, thusly charged with toothpaste under pressure from an actuating gas, is ready for use.

Initially, prior to valve actuation and actual use, it is to be noted that the pressurized toothpaste forces segment **42** of gate **36** against the downstream opening from the valve chamber to the outflow passage **23**. An effective seal between the reservoir **14** and the downstream portion of passage **23** is achieved by making gate **36** a separate element from actuator **37**. Specifically, there can be no pivoting or skewing of the gate and actuator about an axis transverse to flow, which skewing might tend to prevent flush positioning of the downstream side of gate section **42** against the opening to passage **23**. The structural separation of actuator **37** from gate **36**, therefore, assures a proper seal when the valve is closed.

In order to dispense toothpaste from reservoir **14** to the bristles **26** at head **13**, push-button actuator **37** is depressed radially into the handle body by the thumb or other finger of the user. This movement of the actuator **37** is effected against the bias force of spring **35**. The spring is thereby axially compressed as gate **36** and actuator **37** move in the valve chamber radially with respect to the longitudinal axis of passage **23**. When any portion of gate aperture **40** is aligned with passage **23**, pressurized toothpaste from reservoir **14** is forced through the now open valve and passage **23** to the bristles **26**. By controlling the extent of depression of push-button actuator **37**, the area of gate aperture **40** aligned with passage **23** may be selectively controlled. Accordingly, the size of the valve opening can be controlled to thereby control the flow rate of toothpaste to the bristles.

As toothpaste is dispensed from reservoir **14**, the piston **21**, under the pressure of the actuating gas filling its upstream interior space, moves downstream. The pressurized actuating gas expands to fill the increasing volume of this upstream space. The actuating gas pressure acts in all directions in the upstream space to maintain the annular wall of the piston **21** in flush contact

with the boundary wall of the reservoir to assure that toothpaste disposed along the boundary wall cannot become trapped between the piston and the wall but instead is extruded or pushed downstream and eventually dispensed. In this regard, the piston sidewall, although essentially rigid, is sufficiently resiliently expandable to permit it to be forced against the reservoir boundary wall. It will therefore be appreciated that the shape of the piston sidewall must match the shape of the reservoir boundary wall, whether that shape be of circular cross-section as shown in the drawings or any other desired cross-section.

As the space upstream of piston **21** expands due to the dispensing of toothpaste from the reservoir, the pressure of the actuating gas necessarily decreases. Therefore, it is important that the initial gas pressure be selected to assure that the final pressure is sufficiently high to force toothpaste through the open valve and passage **23**. For a reservoir having a total volume of 2.93 cubic inches of which 0.5 cubic inches are initially disposed upstream of the piston, an initial gas pressure of thirty psig results in a final gas pressure of five psig when the piston has been translated to its extreme downstream position. This final gas pressure is sufficient to effect dispensing of the toothpaste.

Slot **43** combines with reduced thickness segment **42** of gate **36** to prevent the gate from becoming stuck in the open valve position in the manner described above. Specifically, in the absence of slot **43**, segment **39** would transversely fill the generally elliptical bore portion of the valve chamber. During actuation of such a gate, air or toothpaste in bore **33** and the adjacent portion of bore **31** would resist movement of the gate but would eventually be forced around the sides of the gate to permit valve actuation. However, once such a gate is fully actuated, a partial vacuum would be created in the lower (as viewed in FIGS. **2** and **3**) part of the valve chamber to thereby resist return of the gate to its closed position under the force of spring **35**. The toothpaste surrounding the valve chamber would prevent any air or toothpaste that might be in or near the upper part of the chamber from leaking around the gate body to fill the partial vacuum, and the gate would tend to be held by the partial vacuum in the open position. Slot **43** and the reduced thickness of gate segment **42**, on the other hand, prevent creation of a partial vacuum by permitting toothpaste from reservoir **14** to enter the lower part of the valve chamber when the valve is open.

It is to be understood that the cup-like piston **21**, pressurized by gas on its upstream side, and the floating valve **36** constitute a novel arrangement for continuously pressurizing and selectively dispensing a viscous medium, such as toothpaste. Although the valve arrangement disclosed herein is particularly advantageous when combined with the gas-driven cup-like piston, the latter will nevertheless function to advantage with other types of valves. Likewise, the unique valve structure disclosed herein may be employed in connection with any suitable technique for pressurizing the toothpaste and is not limited to the gas-driven cup-like piston.

The valve and piston disclosed herein may be utilized in systems other than fountain toothbrushes to dispense liquid or viscous materials.

Toothbrush assembly **10** is preferably manufactured as a disposable unit whereby the entire assembly would be disposed of after the toothpaste has been dispensed. Alternatively, it maybe desirable to fabricate the assembly so that reservoir **14** can be refilled with toothpaste and charged with pressurized actuation gas upstream of the piston.

By way of example only, and not to be construed as limiting on the scope of the present invention, the following is a list of dimensions and parameters for an operational embodiment of the present invention: outside diameter of cylindrical handle **11**—1.2 inches; inside diameter of handle **11**—1.063 inches; axial length of reservoir **14**—3.3 inches (not including tapered space **22**); axial length of tapered end **22**—0.0175 inches; length of section of passage **23** upstream of valve chamber—0.075 inches; diameter of passage **23** immediately downstream of valve chamber—0.188 inches; diameter of reduced thickness section of passage **23**—0.125 inches; length of passage **23** between valve chamber and reduced thickness of passage—1.90 inches; total length of handle **11**, section **24**, stem **12** and head **13**—7.00 inches; diameter of bore **30**—0.400 inches; axial length of bore **30**—0.25 inches; major dimension of cross-section of bore **31**—0.400 inches; minor dimension of cross-section of bore **31**—0.205 inches; axial length of bore **31**—0.750 inches; diameter of bore **33**—0.200 inches; axial length of bore—0.158 inches; major dimension of cross-section of gate sections **39** and **42**—0.395 inches; minor dimension of cross-section of gate section **39**—0.200 inches; height of gate section **39**—0.229 inches; minor dimension of cross-section of gate section **42**—0.133 inches; diameter of gate aperture **40**—0.125 inches; diameter of actuator **37**—0.197 inches; diametric thickness of flange **41**—0.200 inches; length of actuator **37**, including flange **41**—0.475 inches; outside diameter of retainer **38**—0.402 inches; inside diameter of retainer **38**—0.225 inches; axial length of retainer **38**—0.250 inches; outside diameter of piston **21**—1.063 inches; inside diameter of piston **21**—1.033 inches; axial length of piston **21**—0.707 inches; taper of annular sidewall of piston **21** in downstream direction—1.0°; volume of piston interior—0.5 cubic inches.

The materials employed for assembly **10** can vary considerably while still permitting the assembly to operate as intended. By way of example, the handle **11**, tapered section **24**, stem **12** and head **13** may be an integral molded member of Delrin 900 HT; piston **21**, actuator **37** and gate **36** may be UHMW Teflon; end cap **15** and retainer **38** may also be Delrin 900 HT; and plug **19** may be thirty durometer neoprene.

There is a tendency for toothpaste to harden or "cake" when exposed to air because of evaporation of water from the paste. This hardening would occur at the egress opening of outflow passage **23** at surface **25** if assembly **10** is not used for a few days. The hardened paste tends to block the egress of paste being dispensed. One way to solve this problem would be to increase the gas pressure sufficiently upstream of piston **21** to force the "caked" toothpaste through the egress opening. Another approach to solving the problem is illustrated in FIG. **5** to which specific reference is now made. A flexible orifice in the form of a frusto-conical member **50** is disposed about the egress opening of passage **23** at surface **25** and projects from that surface with a decreasing diameter. The material employed for member **50** may be rubber or other suitable elastomer material of small thickness so as to be capable of permitting its raised egress opening to expand as the pressurized toothpaste flows therethrough. When toothpaste is not being dispensed, the egress orifice contracts to present a relatively small opening exposed to air. The toothpaste may tend to harden at the small opening, but the hard-

ened material is quickly cleared during the next dispensing operation as the orifice widens in response to the pressurized toothpaste. Other forms of flexible openings may be employed to effect the function described. For example, the opening of passage **23** at surface **25** may be covered with a flat piece of elastomeric material secured to the brush head only at a portion of its periphery to serve as a flapper valve.

Other modifications for the fountain toothbrush of the present invention are illustrated in FIGS. **6** and **7** to which specific reference is now made. The fountain toothbrush is provided with a snap-on type cover **60** in the form of an elongated hollow member closed at one end **61** and open at the other end **62**. Cover **60** is contoured to receive the head **13**, stem **12**, tapered section **24** and part of handle **11** including actuator **37**. The material from which cover **60** is fabricated is sufficiently flexible to permit the cover to resiliently engage handle **11** when the cover is positioned on the unit. Cover **60** keeps the bristles clean, eliminates inadvertent actuation of actuator **37** and prevents the wet bristles **26** from contacting and wetting other items in a suitcase, or the like.

The embodiment of FIGS. **6** and **7** also includes a modified end cap **70**. End cap **70** is provided with a flat, rather than concave, base **72** having a central access aperture sealed by an elastomeric plug **71** through which pressurized actuating gas may be delivered to the unit. The diameter of base **72** is substantially equal to the outside diameter of handle **11**. Projecting from the interior surface of base **72** is a hollow cylindrical section **73** disposed concentrically with handle **11** but spaced radially inward from the circumferential edge of base **72** so that the outside diameter of section **73** is substantially equal to the inside diameter of handle **11**. The result is an annular outer lip **74** disposed at the periphery of base **72** and having a radial thickness substantially equal to the thickness of the wall of handle **11**. Cylindrical section **73** thus extends a short axial distance into the handle and, along with lip **74**, is glued to the handle to prevent removal of the end cap.

It is to be understood that, although the most efficient configuration for reservoir **14** and the periphery of piston **21** is cylindrical, other configurations may be employed without departing from the spirit and scope of the invention.

From the foregoing it will be appreciated that the invention makes available a novel fountain toothbrush assembly and a method for dispensing toothpaste to a toothbrush from a self-contained reservoir.

Having described preferred embodiments of a new and improved method and apparatus in accordance with the present invention, it is believed that modifications, variations and changes will be suggested to those skilled in the art in view of the teachings as set forth herein. It is therefore to be understood that all such variations, modifications and changes fall within the scope of the present invention as defined by the appended claims.

What is claimed is:

1. A fountain toothbrush comprising:

an elongated hollow handle containing a sealed interior reservoir with upstream and downstream ends and a boundary wall with a uniform transverse cross-section throughout its length;

a piston disposed for longitudinal displacement in said reservoir and defining upstream and downstream pressure-isolated spaces in the reservoir, said piston having an outer periphery contoured to match the uniform cross-section of said reservoir boundary wall, said downstream space being fully occupied with toothpaste, said upstream space being permanently fully occupied with gas trapped under sufficient pressure to continuously urge the piston in a downstream direction to thereby continuously pressurize the toothpaste occupying the downstream space;

a toothbrush head having multiple bristles secured thereto;

an outflow passage disposed between the downstream end of the reservoir and said head;

actuable valve means for selectively dispensing said pressurized toothpaste by alternatively blocking and permitting flow of toothpaste through said outflow passage;

wherein said piston is a cup-like member with an open end facing the upstream end of said reservoir, a closed end facing the downstream end of said reservoir and abutting said toothpaste, and a continuous sidewall abutting the boundary of said reservoir in flush contact, wherein the pressurized gas in said upstream space resiliently urges said continuous sidewall against the reservoir boundary wall as the piston is urged in a downstream direction; and

a cap secured to said handle to seal the upstream end of said reservoir, said cap including an elastomeric member through which a hypodermic needle may be inserted to deliver said pressurized gas to said upstream space.

2. A fountain toothbrush comprising:

an elongated hollow handle containing a sealed interior reservoir with upstream and downstream ends and a boundary wall with a uniform transverse cross-section throughout its length;

a piston disposed for longitudinal displacement in said reservoir and defining upstream and downstream pressure-isolated spaces in the reservoir, said piston having an outer periphery contoured to match the uniform cross-section of said reservoir boundary wall, said downstream space being fully occupied with toothpaste, said upstream space being fully occupied with gas under sufficient pressure to urge the piston in a downstream direction to thereby pressurize the toothpaste occupying the downstream space;

a toothbrush head having multiple bristles secured thereto;

an outflow passage disposed between the downstream end of the reservoir and said head; and

selectively actuable valve means for alternatively blocking and permitting flow of toothpaste through said outflow passage;

wherein said piston is a cup-like member with an open end facing the upstream end of said reservoir, a closed end facing the downstream end of said reservoir and abutting said toothpaste, and a continuous sidewall abutting the boundary of said reservoir in flush contact, wherein the pressurized gas in said upstream space resiliently urges said continuous sidewall against the reservoir boundary wall as the piston is urged in a downstream direction; and

wherein said valve means comprises:

a valve chamber intersecting the said outflow passage and having a first depth dimension parallel

said outflow passage, a first width dimension transverse to said outflow passage and a first length dimension transverse to said outflow passage and both said width and depth dimensions, said valve chamber having a downstream surface with a downstream opening to said outflow passage;

a gate disposed in said valve chamber for longitudinally slidable movement therein, said gate having a first length section with depth and width dimensions corresponding to the first depth and first width dimensions of said valve chamber to thereby permit said slidable movement, said first length section having an upstream facing slot recessed depthwise therein and extending lengthwise along the entire length of said first length section, said gate having a second length section with a width dimension equal to said first width dimension of said first length section and a depth dimension considerably reduced from the depth dimension of said first length section to thereby provide a gap in the valve chamber at the upstream side of said second section;

wherein said first length section has a gate aperture defined therethrough to permit toothpaste to pass through said valve chamber when the gate is positioned to align the gate aperture with said outflow passage;

bias means for normally positioning said gate in a closed position wherein said second length section is in alignment with said outflow passage to prevent flow of toothpaste therethrough;

actuator means for permitting selective longitudinally slidable movement of said gate in said valve chamber in opposition to said bias means to controllably align said gate aperture with said outflow passage;

whereby said slot in said first gate section prevents formation of a partial vacuum in said valve chamber by providing a flow path between appropriate ends of the gate;

wherein said actuator means and said gate are structurally separate members, whereby movement of said actuator along all dimensions but the length dimension of said valve chamber produces no corresponding movement of said gate, and wherein the second length section of said gate is forced by the pressurized toothpaste to be flush against said downstream surface of the valve chamber in the closed position of the gate.

3. The fountain toothbrush according to claim **2** wherein said actuator means and said gate are structurally separate members, whereby movement of said actuator along all dimensions but the length dimension of said valve chamber produces no corresponding movement of said gate, and wherein the second length section of said gate is forced by the pressurized toothpaste to be flush against said downstream surface of the valve chamber in the closed position of the gate.

4. The fountain toothbrush according to claim **3** wherein said valve chamber includes a first extension section for receiving said actuator means, said first extension section having a longer width dimension than said first width dimension, and wherein said actuator means includes a retainer positionally secured in said first extension section and an elongate push-button disposed in said retainer for slidable movement longitudinally of said valve chamber, said push-button extending into contact with said gate to permit longitudinal movement of the gate in response to longitudinal movement of the push-button.

5. The fountain toothbrush according to claim **4** wherein said bias means comprises a spring disposed in said chamber in contact with said second gate section to urge said gate toward said push-button, and wherein said push-button is disposed to bear against said first gate section.

6. A fountain toothbrush comprising:

an elongated hollow handle containing a sealed interior reservoir with upstream and downstream ends and a boundary wall with a uniform transverse cross-section throughout its length;

a piston disposed for longitudinal displacement in said reservoir and defining upstream and downstream pressure-isolated spaces in the reservoir, said piston having an outer periphery contoured to match the uniform cross-section of said reservoir boundary wall, said downstream space being fully occupied with toothpaste, said upstream space being fully occupied with gas under sufficient pressure to urge the piston in a downstream direction to thereby pressurize the toothpaste occupying the downstream space;

a toothbrush head having multiple bristles secured thereto;

an outflow passage disposed between the downstream end of the reservoir and said head; and

selectively actuable valve means for alternatively blocking and permitting flow of toothpaste through said outflow passage;

wherein said valve means comprises:

a valve chamber intersecting the said outflow passage and having a first depth dimension parallel said outflow passage, a first width dimension transverse to said outflow passage and a first length dimension transverse to said outflow passage and both said width and depth dimensions, said valve chamber having a downstream surface with a downstream opening to said outflow passage;

a gate disposed in said valve chamber for longitudinally slidable movement therein, said gate having a first length section with depth and width dimensions corresponding to the first depth and first width dimensions of said valve chamber to thereby permit said slidable movement, said first length section having an upstream facing slot recessed depthwise therein and extending lengthwise along the entire length of said first length section, said gate having a second length section with a width dimension equal to said first width dimension of said first length section and a depth dimension considerably reduced from the depth dimension of said first length section to thereby provide a gap in the valve chamber at the upstream side of said second section;

wherein said first length section has a gate aperture defined therethrough to permit toothpaste to pass through said valve chamber when the gate is positioned therein to align the gate aperture with said outflow passage;

bias means for normally positioning said gate in a closed position wherein said second length section is in alignment with said outflow passage to permit flow of toothpaste therethrough:

actuator means for permitting selective longitudinally slidable movement of said gate in said valve chamber in opposition to said bias means to controllably align said gate aperture with said outflow passage;

whereby said slot in said first gate section prevents formation of a partial vacuum in said valve chamber by providing a flow path between appropriate ends of the gate.

7. The fountain toothbrush according to claim **6** wherein said actuator means and said gate are structurally separate members, whereby movement of said actuator along all dimensions but the length dimension of said valve chamber produces no corresponding movement of said gate, and wherein the second length section of said gate is forced by the pressurized toothpaste to be flush against said downstream surface of the valve chamber in the closed position of the gate.

8. The fountain toothbrush according to claim **7** wherein said valve chamber includes a first extension section for receiving said actuator means, said first extension section having a longer width dimension than said first width dimension, and wherein said actuator means includes a retainer positionally secured in said first extension section and an elongate push-button disposed in said retainer for slidable movement longitudinally of said valve chamber, said push-button extending into contact with said gate to permit longitudinal movement of the gate in response to longitudinal movement of the push-button.

9. The fountain toothbrush according to claim **8** wherein said bias means comprises a spring disposed in said chamber in contact with said second gate section to urge said gate toward said push-button, and wherein said push-button is disposed to bear against said first gate section.

10. The method of selectively dispensing toothpaste from a hollow handle to a toothbrush head via a passage disposed between and connected to said handle and said head, said method comprising the steps of:

(a) maintaining said toothpaste under continuous pressure by:

(a.1) subdividing said hollow handle into two pressure-isolated distal and proximal subchambers and disposing said toothpaste in said distal subchamber;

(a.2) permanently trapping gas under pressure greater than atmospheric pressure in said proximal subchamber by injecting the gas into the proximal subchamber through an elastomeric member penetrable by a hypodermic needle or the like; and

(a.3) continuously urging a piston in a distal direction by means of the pressurized gas trapped in said proximal subchamber, wherein said piston prevents said pressurized gas from mixing with said toothpaste;

(b) alternatively blocking and passing flow of the continuously pressurized toothpaste to said passage from a distal end of said distal subchamber by means of a manually actuable valve interposed between said distal subchamber and said passage.

11. The method according to claim **10** wherein said valve includes a gate member having a gate opening therein and disposed in a valve chamber located between said distal subchamber and said passage and having a distal wall through which said passage is defined, wherein step (b) comprises the steps of:

(b.1) continuously forcing the gate member flush against the distal wall of the valve chamber by means of the pressurized toothpaste in said distal subchamber;

(b.2) positionally biasing said gate member to a position wherein the gate opening is completely misaligned with respect to said passage; and

(b.3) selectively moving said gate member in opposition to said positional biasing to align said gate opening with said passage to permit toothpaste to flow through said valve opening and said passage to said head.

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